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ABSTRACT

The TI-IN Network is an interactive, satellite-based educational system offering a technological alternative to face-to-face classroom instruction. Developed through a cooperative venture between private enterprise and public education agencies, the TI-IN Network offers a total systems approach by providing the entire programming and hardware package to the user. Curriculum offerings include inservice training for teachers/staff, high school academic courses, student enrichment programming, and tutorials. An evaluation by the Texas Education Agency showed that there was no significant difference between students' performance in a TI-IN classroom and a face-to-face classroom. Another evaluation project being designed by TI-IN will compare baseline data with subsequent data and will analyze the motivations for use and the expectations accompanying use of this technology. TI-IN Network is involved in two projects targeted for special education high school students: (1) Project Help, which implemented system modifications to allow forms of response other than talkback, such as tactile pads, voice recognition machines, etc.; and (2) The Mathematics Magnet School of the Air, which instructs gifted and talented secondary students on higher order thinking skills. (JDD)

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MEETING THE NEEDS OF RURAL SPECIAL EDUCATION IN THE INFORMATION AGE: USING TI-IN NETWORK'S INTERACTIVE SATELLITE BASED EDUCATIONAL NETWORK

Abstract

The following paper details the development and implementation of new technological devices for handicapped students and of a Math Magnet program for gifted students via TI-IN Network, Inc.. The Network, is the first private, interactive satellite based educational system in the country developed for public schools. TI-IN Network offers a total systems approach by providing both the user technology and a wide range of course offerings. An overview of the specific technology employed and the course offerings are detailed. The cooperative partnership between rural public educational institutions and private enterprise is explicated.

The Rural Context

We are all responsible for perpetuating a generalized myth about rural america. For decades, rural areas of the United States have been perceived, usually by urbanites, as victims of cultural isolation and economic deprivation. Others equate the perceived rural isolation with freedom, from a more complex urban lifestyle.

Life in rural regions is idealized as simple, environmentally pure and conservative. These beliefs are responsible in part for creating an inferior image of educational institutions who happen to be located in rural districts. They are frequently depicted as unsophisticated and slow to change. The reality is, rural schools strive for academic excellence.

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They are guided by legislative curriculum mandates that require adherence irrespective of size (small/large), geographic location (urban/rural) and regional economic resources. Likewise, rural programs are required to meet special education needs, i.e., physically handicapped, gifted and talented, of their student population.

New technological innovation has been most prevalent in the rural context. However, people continue to believe that rural residents/students are less amenable to change and generally lack the necessary resources for implementing an innovation. These beliefs are not validated when rural schools adopt the TI-IN Network.

Rural TI-IN Sites : Adoption Grows

The growth of the TI-IN Network, Inc., an interactive, satellite based educational system, illustrates that school administrators in rural public school districts are the vanguard of its nation-wide adoption. Over half of the 205 receive sites report district sizes by average daily attendance (ADA) to be 1,000 or less. School administrators, who adopt TI-IN, have a high interest in the broad range of course offerings to expand their current curriculum. With the cost of the network being less than hiring one teacher, the service is affordable to even the smallest districts.

The TI-IN Network is a technological alternative to face-to-face classroom instruction. All instruction is live and interactive, using one-way satellite transmitted video with two-way audio talkback. After a year and a half of operation, TI-IN Network is made up of 205 receiving sites (with 215 actual end users/subscribers) across 14 states and has a student enrollment of over 1450. Curriculum offerings include, 400 hours of in-service training for teachers/staff, 19 high school academic courses for students, student enrichment programming and tutorials. The courses are broadcast over two-channels, 6 days a week. For rural schools, TI-IN courses offer a creative solution to problems of teacher shortages and new legislative curriculum mandates.

New Technology in the Context of Rural

Over the past two decades, rural america has been the testing ground for a wide array of new telecommunications technologies. The government funded research and demonstration projects, that flourished in the early and mid-1970's, used

telecommunications media to expand educational opportunities in geographically remote areas 1.

The change agents who developed the demonstration projects believed that rural residents and institutions, with inherent geographic barriers, needed easier access to information/resources. Elton and Carey (1980) suggest that many assumptions of perceived user needs for technological applications are outweighed by the actual financial costs. For several of the demonstration projects the strong user demand never emerged. Many of the technological choices were too costly after the government funding ended. The high cost of the application was cited as the principal reason for ultimate non-adoption.

While, using video telecommunications media for education in rural areas is not new, the pre-conditions to make it affordable and successful are. Recent state legislative curricula mandates; the decreasing cost of satellite hardware and transmission time; and a cooperative venture between public sector institutions and private enterprise are factors which converge making satellite based education services feasible.

TI-IN Network Responds to Rural Special Education Needs

The TI-IN Network was conceived to equalize academic resources available to high school students and teachers. The TI-IN Network's roots are in Texas. At the time of its inception, Texas, not unlike other states, increased the curriculum requirements for high schools through legislative mandates.

A general teacher shortage, especially acute in specific subject areas (ie., foreign languages, computer math), coupled with increased budgetary demands of local districts, made compliance nearly impossible. For mathematics courses, a 1981 survey of 45 states indicates that shortages of math teachers is

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1 Examples of the variety of educational applications include: training vocational rehabilitation counselors via audio teleconferencing (Pease, 1983); continuing medical education for health providers via terrestrial based microwave video with audio talk back (Niemiac, 1983); continuing education for extension agents using audio teleconferencing and other narrow band video applications (ie., slow scan, electro-writers) for enhancement (Parker, 1979); multiple uses of cable television with a telephone dial-in for student homework tutorials and course offerings (Pease, 1982; Boyle, 1982).

acute in 43 states.2 Overall, the National Center for Educational Statistics estimates that over 200,000 new teachers will be required by 1991.3 TI-IN provides a solution to the plight of high schools by offering the courses which are both mandated and highly specialized for the gifted and talented student.

TI-IN evaluates both the user needs and their geographic locations to match their needs with the attributes of the satellite receive technology. Using Ku-Band satellite transmission permits any school located in the continental United States to receive these resources. As a private company, TI-IN is able to engineer, maintain and market the state-of-the art technology. The services are affordable, the initial subscriber costs, including approximately $8,400 in one-time equipment cost, are less than hiring one teacher.

Private Enterprise and Public Education Merge

The successful development of TI-IN stems from the cooperative venture between private enterprise and public education agencies. The partnership began between TI-IN and the Texas Region 20 Educational Service Center located in San Antonio. Region 20 is the critical link for the Network by providing the broadcast (up-link) facility for program origination. The Region 20 staff select the best qualified, certified high school teachers and submit the lesson plans for each course to the state education agency. By approving the lesson plans, state or local education agencies award academic credit for the courses taught via TI-IN.

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2 The National Commission on Excellence in Education, A Nation at Risk, April 1983, p.18.

3 Bowen, Ezra "And Now, A Teacher Shortage," Time, July 22, 1985, p.63.

Table 1. High School Courses 1985-86:	
Channel A	Channel B
Honors Calculus	U.S. Government
Latin I	Spanish I
Computer Science	Computer Math
Personal Business	French I
Business Law	Trigonometry
Psychology	German I
Sociology	Elem. Analysis
	Pre-Calculus

Region 20 provides the necessary staff to manage the operation of its multiple studio facility. A curriculum expert works with each instructor to maximize their use of the multi-media features available on the TI-IN system. All of the TI-IN teachers report a low use of media in their previous face-to-face classroom instruction. The results of a end of the year survey suggests that TI-IN teachers report their teaching style has changed to incorporate multiple media (ie., slides, videotapes, pictures, graphics). Instructors are taught skills in how to maximize the two-way audio interaction with students.

Special education projects are funded. By combining the curriculum expertise of the Region 20 staff and the technical expertise of TI-IN, two grants were funded from the U.S. Department of Education. One grant, the development of a Mathematics Magnet School of the Air, is targeted to gifted and talented students. A second grant from discretionary funds has resulted in the research and development of new technological devices to assist physically and learning handicapped students to utilize TI-IN's satellite curriculum.

Serving other time zones and sharing resources. TI-IN continues to cultivate relationships with other public education agencies interested in providing broadcast facilities. For the school year 1987-88, TI-IN will offer courses originating from a California State University at Chico. Chico will act as a TI-IN affiliate offering graduate level teacher education on a third TI-IN channel. This broadcast site will add to the present resources available to subscribers.

State education departments across the country are evaluating TI-IN's total educational approach. They are considering its economic advantages for potential national resource sharing.

A "Total Systems" Approach to Implementation

TI-IN differs from other applications of satellite based technology, it brings the entire programming and hardware package to the user. TI-IN leases the satellite transmission time, registers students, coordinates and contracts with nationally know inservice trainers and works alongside Region 20 on program development. Dissemination of information about the TI-IN Network to potential subscribers is an on-going activity.

The user equipment is engineered by TI-IN specifically for the primary user population (students). They install, maintain and monitor the nationwide operation of the Network. Technological obsolescence of equipment is prevented by system-wide modification and replacement of component parts.

Characteristics of the receive equipment. A TI-IN site is equipped with a receive-only satellite antenna and the TI-IN audio-video (AV) cart. The AV cart is a self contained unit on wheels, making it transportable for easy installation in any room. Each cart has a television monitor for video reception of the instructor, a videocassette recorder for storing missed class lessons, four cordless telephone handsets with automatic dial to facilitate student and teacher interaction, an electronic writing tablet for written feedback, a satellite receiver, and the signal descrambling device.

For security reasons a dot matrix printer is stored in a locked compartment in the bottom of the AV cart. Tests and other written information are sent from the broadcast facilities via the satellite to each receive site, this information is printed out on the dot matrix printer. The talkback and copy distribution capabilities of TI-IN are made possible by use of a proprietary Multi Function Interface Unit (MFIU). The MFIU is stored in the AV cart.

The installation of the TI-IN hardware enables each site to receive two video channels with a total of over 20 hours of programming to select from. All interaction is live and made possible through toll-free telephone WATS lines. For user convenience, the toll-free WATS number is transmitted within the satellite signal and processed by the MFIU so that, with a flick of the button, located on the handset, the number to an instructional studio is automatically dialed.

Using the technology as a communications network. As the subscriber base increases and the programming resources grow, the TI-IN Network plans to expand to eight channels. Use of the Network for statewide or national meetings is expected to grow as adoption becomes widespread. Education administrators view the Network as a communications tool as well as an instructional medium.

User Evaluation of TI-IN

From its inception, the TI-IN Network, Inc., has been committed to the development of a long-term research plan. The application of this innovation within the context of public high schools is new. A comprehensive research and evaluation of the effectiveness of the media, course satisfaction by the users and the perceived ease-of-use of the hardware are critical to understanding the factors which contribute to a successful/unsuccessful adoption.

Research Overview

The TI-IN staff worked in conjunction with the Texas Education Agency (TEA) and the Region 20 Educational Center to evaluate the first year of operation. The TEA decided to collect data at the mid-year point, only. Comparisons in their study are drawn between the completion of a mid-term final by TI-IN students and students instructed in the same subject but in a face-to-face classroom. TEA's results indicate that there is no statistically significant difference between students performance in a TI-IN classroom and a face-to-face classroom.

TI-IN's approach is to collect a baseline of all the research populations. The baseline serves as a measuring stick whereby long term growth and development may be assessed. Too often this step in data collection is lost when a new technology is being implemented (Carey and Moss, 1985). The actual baseline was collected prior to system-wide use in September, 1985. Subsequent data collection points include, mid-semester course evaluations, a mid-year (end of first semester) and year-end evaluation.

Self-administered survey instruments were developed and administered to five research populations: TI-IN teachers, public high school administrators (the decision makers), TI-IN's classroom facilitators (monitors), TI-IN students (users) and their parents. The results of the administrator (decision maker) and student (user) data collection are the focus of the following discussion.

Rationale

The theoretical underpinnings of this evaluation are built on Rogers (1982) diffusion of innovation theory. In his landmark book, Rogers suggests that the rate of diffusion of an innovation is a process influenced by four interrelated constructs: (1) the relevant social system, (2) the timing of the adoption, (3) the communication channels and information used to learn of the innovation and (4) the attributes of the innovation. Rogers

defines an innovation as, "an idea, practice, or object perceived as new by an individual or unit of adoption."

TI-IN offers a new technological innovation which is being melded into a traditional educational context, where face-to-face instruction is the long standing model. Public secondary educational institutions are the relevant social system for its adoption. High school teachers, students, administrators and support staff compose the adoption unit.

The criteria of "time and rate of adoption" are used to classify the degree of innovativeness of public school administrators. The five categories include: innovators, early adopters, early majority, late majority and laggard. Those administrators who implemented TI-IN during the school year 1985-86 would be classified as "innovators." Most of the "innovators" are administrators in rural school districts. They took the greatest risk by first adopting an enterprise, then unproven. 4

Purpose of the study. The purpose of this study is to understand the reasons for use and the trends of adoption. The research examines the motivations that underlie student use and administrator adoption. Expectations regarding the benefits and the utility of using the technology are examined through general attitudes, beliefs and specific attitudes toward change and innovation. Students evaluate the content of each course for overall course satisfaction. Demographic characteristics (ie., sex, age, media experience) of the users and decision makers are examined.

Establishing user needs for advanced math curriculum and handicap students. TI-IN has surveyed school administrators and teachers in order to determine the extend of both the need for math programs and for the specific advanced level math curriculum. A survey of hardware vendors to access technological status and school administrators to define the student population has aided in the development of new technological devices for physically and learning disabled students.

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4 For more information regarding the employment of the diffusion theory in the research design, refer to the article written by Pease and Tinsley, "TI-IN Network: evaluating the diffusion and adoption of an interactive-instructional satellite system." In, Lorne Parker and Chris Olgren Teleconferencing and Electronic Communication V. University of Wisconsin Extension, Madison, Wisconsin, 1986.

Overview of TI-IN's Special Education Projects

TI-IN Network is involved in two specific projects that are targeted for high school students with special education needs. While much of TI-IN's academic satellite programming may be especially useful to gifted and talented students, the two special projects allows TI-IN to develop curriculum and technological aids for not only gifted and talented students but, handicapped ones as well.

Adapting Equipment for Handicapped Students

In 1985, TI-IN was awarded a grant by the U.S. Department of Education's Educational Research & Improvement Grants. The project is referred to as Project Help: A project to aid handicapped individuals in the use of satellite educational instructional facilities.

Project Help is a multi-phased planning, research & development project. Phase 1, the planning and research phase, was completed at the end of the school year of 1985-86. Phase II, the development and implementation stage, will be complete at the end of the 1986-87 school year.

Summary of Phase 1: Data were reviewed from the Texas State Department of Education regarding the number of and types of handicapped students in grades K-12. A detailed breakdown of the number of and types of handicapped students within the schools who are TI-IN subscribers were determined. Basically, the population requires alternative ways for students to interact with other students and teachers (instead of voice-only).

Using the information from the data analysis, equipment modifications were determined based on the physical capabilities of the handicapped population. An extensive study was conducted of the research studies where technology was implemented for handicapped students and of the hardware companies who make adaptive technological devices.

In the end-of-the-year report, the major modification to the existing system was the addition of a digital data return link in order to allow forms of response other than just talkback via a telephone circuit. A digital return would enable students to use a variety of communication devices which require a personal computer. These devices include reading machines for converting printed material into synthesized speech; tactile pads for use by the blind and/or deaf, voice recognition machines, etc. Therefore, phase I with a conceptual design for modifying the TI-IN Network equipment (both classroom and studio/headend) for interfacing with computers. Though, the adaption of a digital

interface will be used within the TI-IN Network, it can be made compatible with any satellite based system and with any type of computer-based communication aid.

Phase II: Modification has been made to the TI-IN headend equipment to allow the transmission of a digital signal through both the telephone lines and the television broadcast signal. Six TI-IN locations serve as the pilot sites where digital modification are in place. By the end of phase II an evaluation of the feasibility and satisfaction of the digital interface and communication aids will be reported.

The digitizing of a broadcast signal allows for the addition of a writing pad. When a student uses the writing pad in an interactive sense, the retransmission of the written word is sent to other receive sites where all the program participants may view the response.

The six pilot sites are testing several different communications aids. Each will be evaluated for their effectiveness. The writing pad is the communications aid that will become an integral part of the TI-IN Network in an effort to serve all students. The implications of Project Help and suggestions for the future are part of the final report in June, 1987.

The Mathematics Magnet School

The Region 20 Educational Service Center located in San Antonio, Texas, and the TI-IN Network are working cooperatively on a grant to establish a Mathematics Magnet School of the Air. Region 20 was funded under Title II of the Education for Economic Security Act, Secretary's Discretionary Programs. The Math Magnet Project is demonstrating that all students can have access to appropriate and high quality instruction through the use of existing state-of-the-art technology (ie., TI-IN's satellite based network).

The Math Magnet project began in January, 1987. In the first stage, Region 20 and TI-IN staff are identifying the following: potential participating sites, the specific math courses desired, the instructors and students. A mass mailing of TI-IN information packets that detail the Math Magnet Program is being mailed to all current and prospective Network subscribers across the nation. Interested schools will be given a detailed implementation guide explaining step by step student entrance requirements, equipment needs, costs, and local commitments necessary for success.

Secondary students are being selected on existing criteria. The Region 20 staff and nationally recognized experts in gifted and talented education will serve as consultants to participating

schools. Localized committees of teachers, administrators, counselors, parents, and others will be established to select students; the advisory committee will meet throughout the first year. Local committees can meet as a national committee via TI-IN's network.

By late spring the courses and instructors will be identified. Instruction will focus on higher order thinking skills to challenge the gifted and talented student. Teachers selected for the project must have an outstanding record of performance in teaching mathematics to gifted and talented students. Tutoring will be a combination of live interactive television broadcasts, a toll-free "800" number and computer conferencing. Office hours will be established whereby students may call the instructor using a toll-free number.

To maximize the interactive attributes of the satellite network, course content, teaching strategies, and instructional materials will be developed. All course designs will be approved by the state agency to ensure that honors and advanced placement credit may be given.

Technologically, the TI-IN Network will expand the instructional capabilities of the present system by adding the computer and electronic writing boards. The computers will allow a computer bulletin board/messaging system to be established; all tests will be electronically tabulated using the computer interface. The writing boards (like the ones used in Project Help) will allow students to write questions and examples to math problems. Both communication aids add more overall interactivity to the instruction. The instructional effectiveness of the Math Magnet Program will be enhanced by the technological up-dates.

The Program is scheduled to begin in September, for the 1987-88 school year. Region 20 will conduct an multi-phased evaluation of the first year.

The Math Magnet Program is an exciting project which has national application. Using TI-IN's satellite based network allows students from small, rural and isolated sites to have equal access as their counterparts in large, urban ones.

Today, high school students located in rural districts such as, Dime Box, Texas, are successfully participating in credit bearing courses not before available. These students have classmates who are located in rural sites throughout Texas, California, Arkansas, Nebraska, Nevada, Oklahoma, Kansas, Iowa, South Dakota, Minnesota, Mississipi, Colorado, New York, Vermont and Michigan. For these districts, TI-IN offers an alternative for overcoming geographic and curriculum limitations.

By offering a "total systems approach," TI-IN is able to meet the conditions for success. First, TI-IN offers a service that is important to school districts. The overall evaluation of administrators (innovators) indicate that TI-IN meets their curriculum and budgetary requirements.

Second, TI-IN makes the technology and the programming compatible with user skills and norms. The technology is simple to operate. Installation requires no room modification for subscribers. The instructional techniques TI-IN teachers use are analogous to a face-to-face class, this minimizes the time users need for adjusting to TI-IN technology and programming. All instruction is live and interactive, students are expected to be attentive, to be active participants and to complete their homework.

Third, the cost of TI-IN subscription is competitive with the traditional face-to-face classroom. Administrators, who were subscribers last year, evaluated this system overall as "cost effective and less expensive than hiring a teacher."

The factors of compatibility, ease of use and cost effectiveness may explain why more administrators across the nation are adopting TI-IN. In September, 1986, the student population more than quadrupled to over 1450 registrants.

The TI-IN Network offers an opportunity to serve the special needs of students with high quality instruction and cost effectively. The state-of-the-art technology provides maximium use of student/teacher interaction via a wide variety of communication aids. The potential of the media is limited only by the imagination of administrators, teachers and students.

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